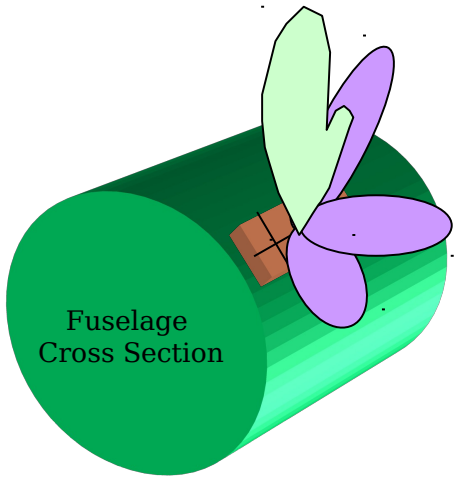
MILSATCOM Industry Days
16 – 20 June 2003

Wideband Communications Antenna System



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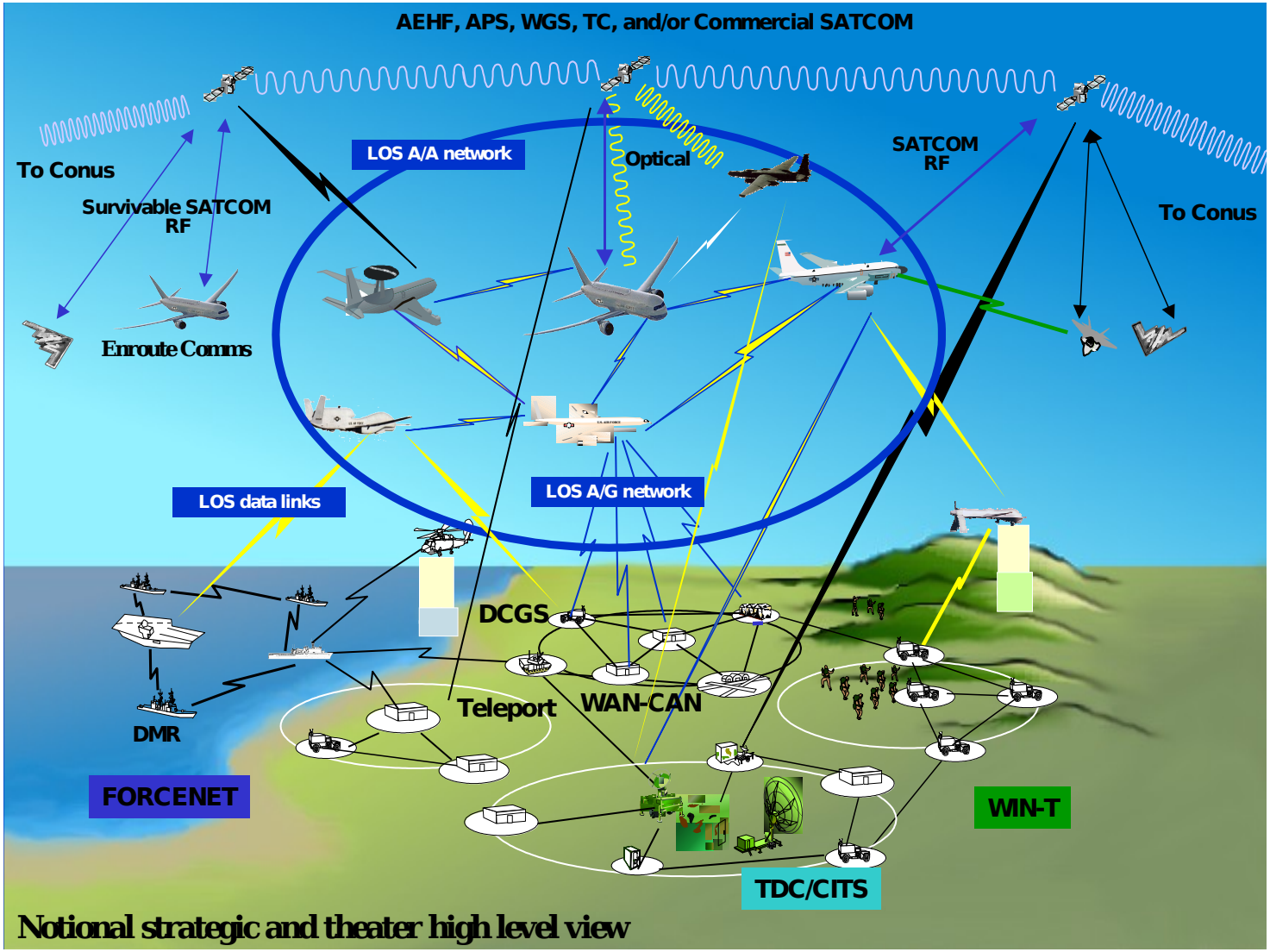
Goals of Industry Interaction

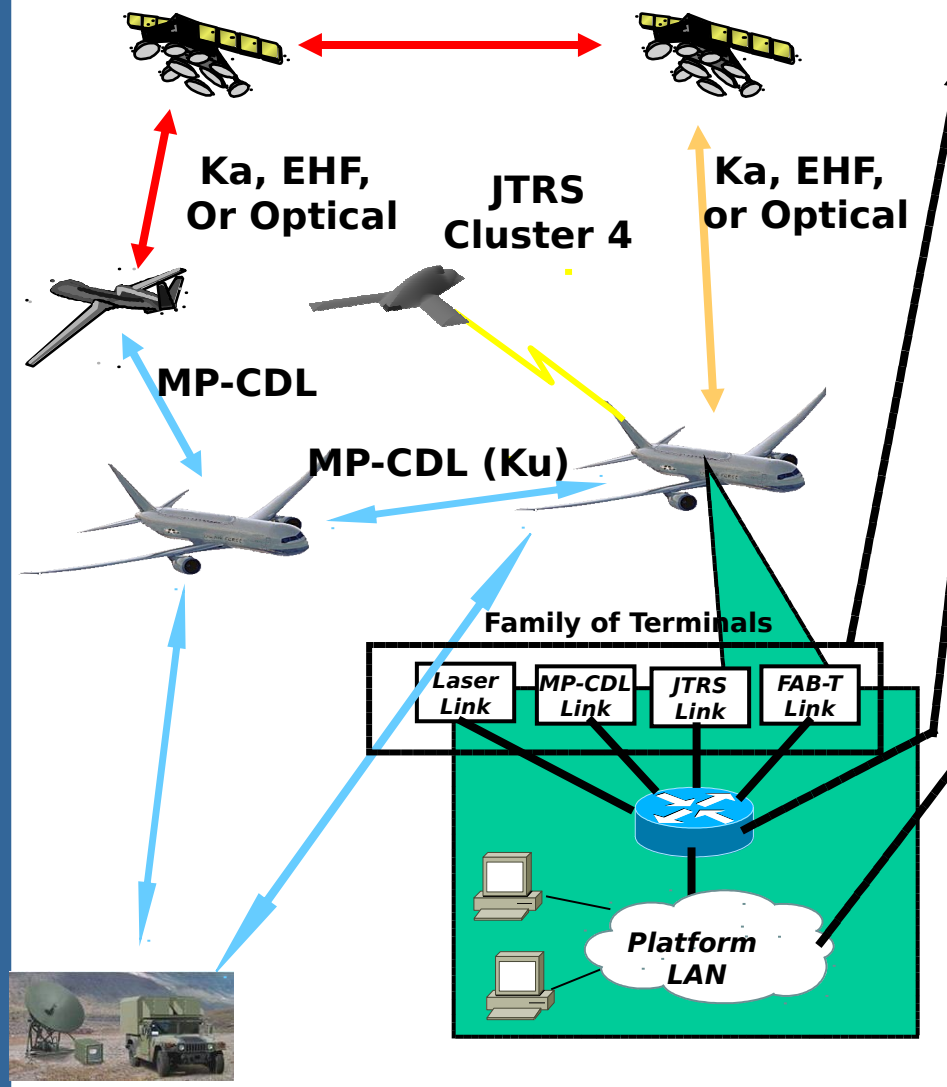
- Present the drivers for a new airborne antenna system
- Survey industry activities
- Assess maturity of the different technologies
- Focus future industry R&D to meet warfighter needs
- Request industry input into technical requirements
- Request industry input into acquisition strategy formulation
- Request industry input into capabilities vs. cost drivers

Successful program dependent on Government/Industry tea

Motivation: Enable Dynamic Network Connectivity & Platform Missions

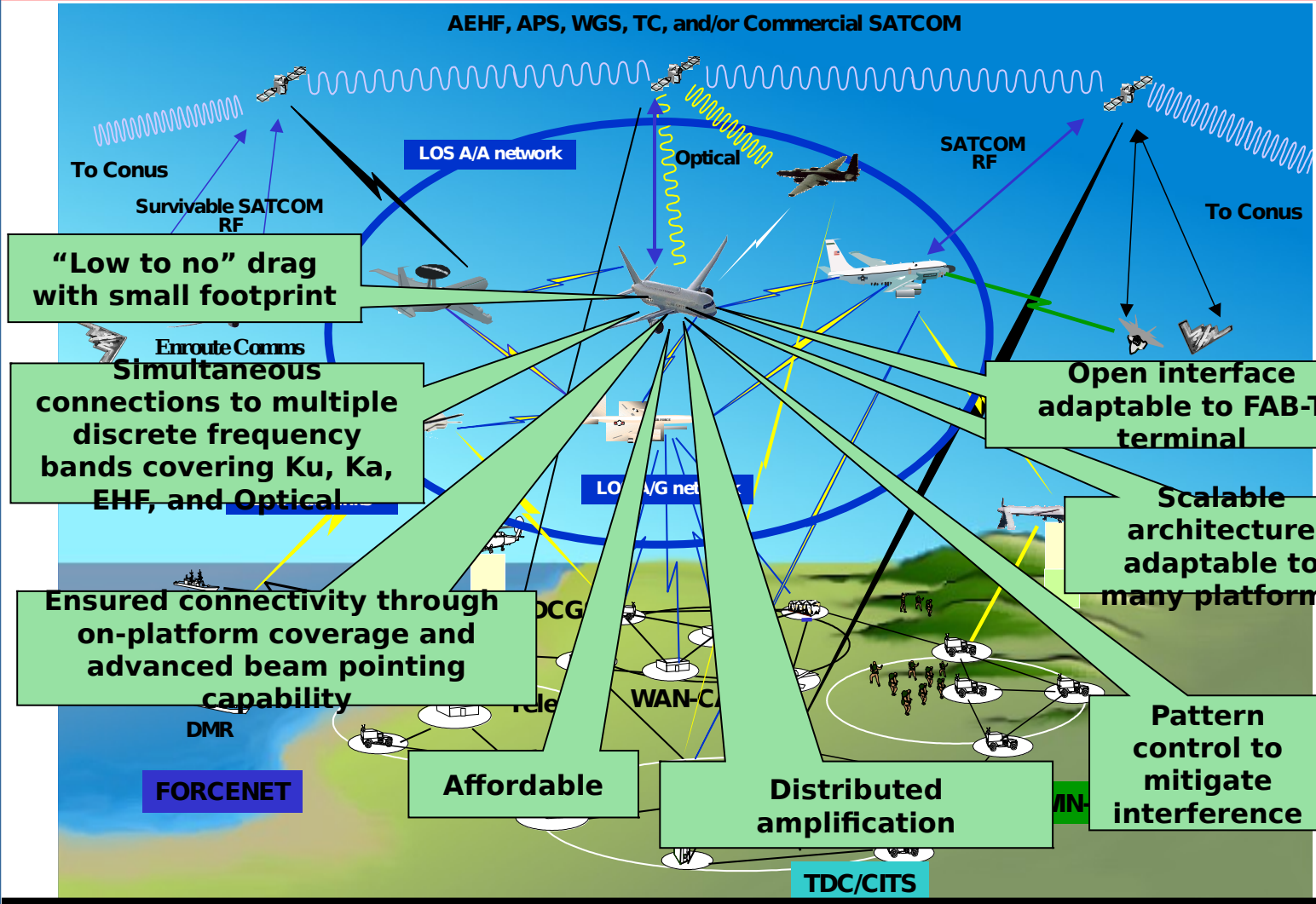


Network Centric Support



- Network-enabled links
  - Multiple communication solutions to airborne platforms
- Integrating network architecture
  - Internetworking between comm solutions creates robust network
  - Link diversity increases network and application availability
- Network-enabled platform infrastructure
  - On-board LAN extends network capability to end users
- Family of Terminals dynamically supports reconfigurable network topology

Mission Needs



Antenna is an enabler for future spirals of the FAB-T and other TC

Challenge

As connectivity requirements increase… this could happen to the i

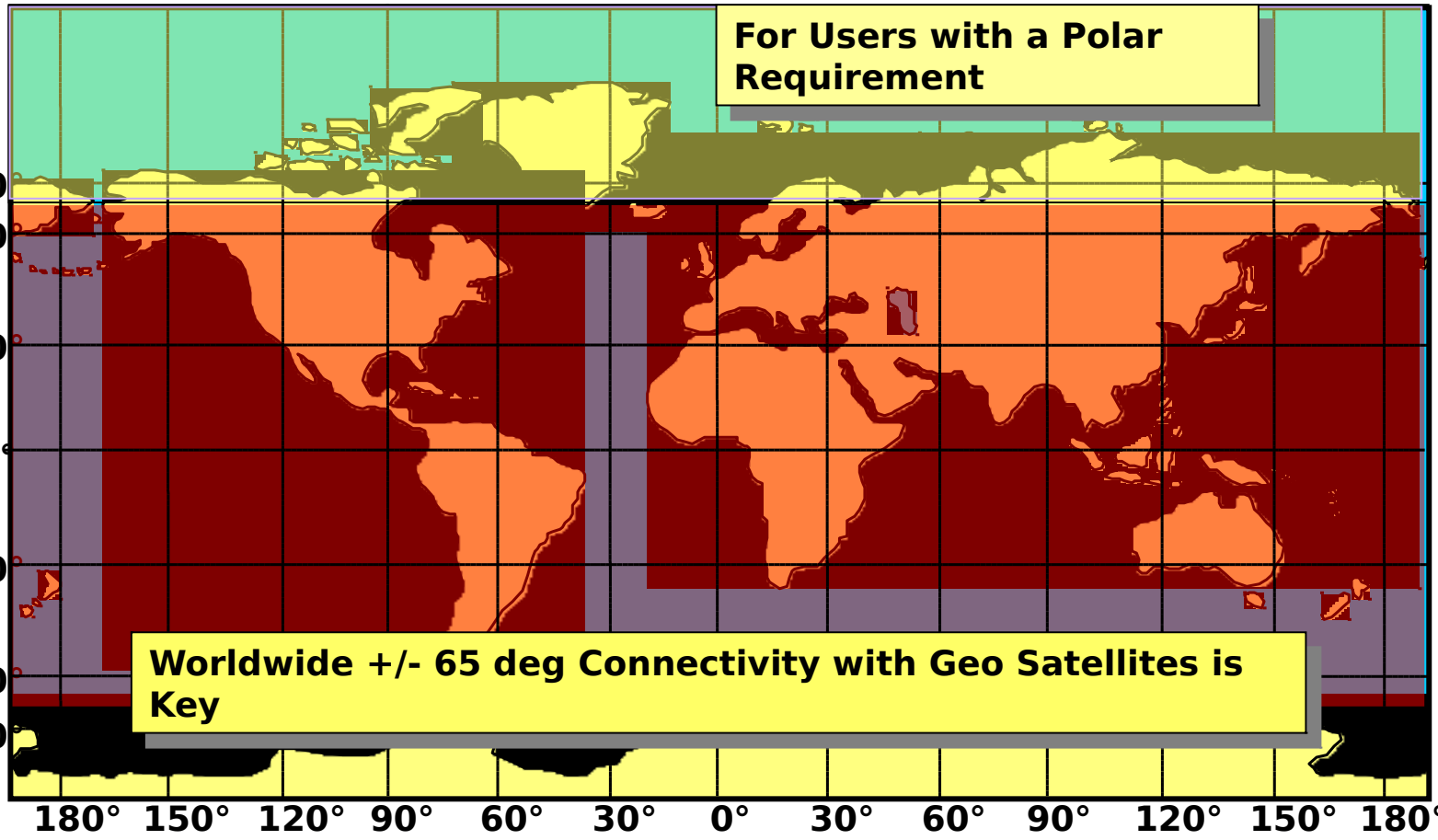
Frequency Requirements

- Create antenna architecture to meet operational requirements of multiple communications systems
  - **AEHF (wideband Milstar)**
  - **Wideband Gapfiller System (WGS)**
  - **Global Broadcast System (GBS)**
  - **Commercial Ku and Ka**
  - **Transformational Communications System (TSat and APS)**
    - Optical communications is on the horizon
  - **Common Data Link (CDL)**
- Multiple simultaneous steerable beams

Transmit	Receive
43.5-45.5 GHz RHCP 27.5-30.0 GHz Dual CP	20.2-21.2 GHz Dual CP
30.0-31.0 GHz RHCP	17.3-20.2 GHz Dual CP
14.0-14.5 GHz Dual Polarization	10.95-12.75 GHz Dual Polarization
14.4-14.65 GHz LHCP	14.9-15.2 GHz LHCP

Need Industry Input into the Evaluation of Associated Cost and Complexity to Meet the Requirements

Coverage Requirements



Meet or exceed today's requirement of 5 to 90 degrees in elevation and 360 degrees in azimuth

Size & Form Factor Requirements

- Minimal to no penetration into the airstream - minimize drag
  - **Seeking information regarding ability of concept to support conformal installation**
- Minimal fuselage penetration (ex: only cutouts for data and power cables)
- Minimal structural modification to fuselage

Will Seek Contractor Analysis of Antenna Impact on Aircraft Performance

"Scalability" Requirements

- Desire a scalable architecture adaptable to meet user/network connectivity and mission requirements
- Antenna aperture to be scaled in size (one or more modules)
  - **To meet antenna requirements of different types of platforms**
- Common antenna building-blocks provide significant cost reductions (development, manufacturing, maintenance)

Need Industry Input into Feasibility to Meet the Scalability Requi

Pattern & Beam Control Requirements

- Beam Control
  - **Signal tracking - Ability to locate and track signals through platform maneuver**
  - **Seamless hand off between apertures**
  - **Co-boresight accuracy - maintain alignment of transmit and receive beams**
  - **Beam update rate - Maintain beam alignment while hopping**
  - **Beam calibration - Accurately and effectively determine relative beam positions**
  - **Real-time beam management - interference mitigation through sidelobe control**

Pattern & Beam Control Requirements (Concl.)

- Sidelobe envelope
  - **Specified for each frequency band**
  - **Driven by waveform**
  - **Negotiated by Joint Spectrum Center**
  - **Commercial bands defined by ITU**
- Axial ratio
  - **Long term satellite design concern**
    - Orthogonal polarizations being proposed off same satellite
    - High axial ratio generates interference
  - **Industry to address how accurately axial ratio can be controlled over FOV**

Additional Requirements

- RF emissions requirements
  - **Out of band emissions**
  - **Phase Noise**
  - **Linearity**
- S/V
  - **Survivability, static electricity, and lightning strike requirements from FAB-T need to be re-evaluated**
  - **Radome is design element in meeting these requirements**
- Interface to FAB-T
  - **FAB-T TRD specifies open and standard interface**
  - **Contractor must conform to interface under development by FAB-T prime**

Requirements Environment

- Antenna will be key component within TC, Family of Terminals, FAB-T, and Platform environment
  - **“ilities” initially derived from multiple sources**
- Cost of some requirements are interrelated depending on how addressed in operational system
  - **Reliability**
  - **BIT**
  - **Maintainability**
- Need to balance all these requirements

Request industry input into tradeoffs which will influence syste

Technical Challenges to Performance, Producibility, and Affordability

- Government has desire to focus on areas that address technical challenges
- Seeking technical trade-space to include the following technical elements:
  - **Beam forming and beam steering over FOV**
    - Digital interface to terminal could make design more scalable
  - **Thermal management**
  - **Power Amplification**
  - **Monolithic process technologies**
  - **Manufacturing processes**

Cost Methodology

- Government desires improved cost modeling capabilities
  - **Early focus on identifying installation costs**
  - **Insight into other cost drivers**
- One-on-one discussions to go over cost estimate methodology
  - **Request industry input into production & installation cost estimating methodologies**
  - **Would like to understand individual cost models**

Government would like to be able to use your cost models

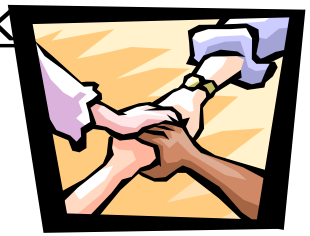
Candidate Platforms

- **Wideband Antennas**
- Goals
- Motivation
- Network Centric Support
- Mission Needs
- Technical Requirements
- Technical Challenges
- Cost Methodology
- **The Way Ahead**

Everything that Flies, Drives, Walks, or Floats

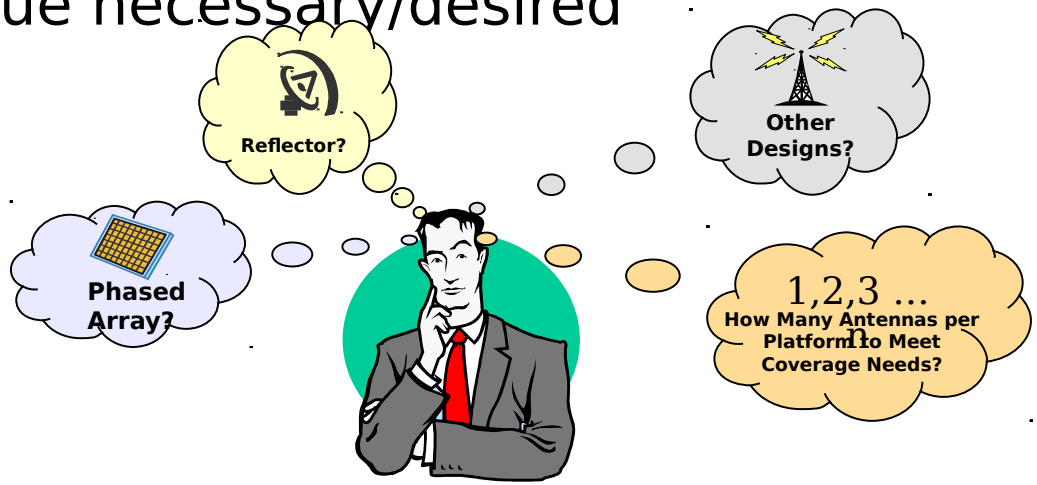
Strategy

- Government has identified areas that are key to success
- Government developing understanding of market state of the art in key technologies and processes in order to refine our baseline
- Getting together (1-on-1)
  - **Understanding your capabilities and the current state-of-the-art**
  - **Understand the realm of the possible alternatives**
    - Cost, schedule, capability, etc…
  - **Listen to your thoughts about a program strategy**
- Develop a Strategy that Makes Sense
  - **2nd Industry Day is a possibility**
- Most Important of All: Teamwork



Summary

- Moving towards the environment of TC, FoT, and Platform/Mission specific communications
  - **Operational requirements still being drafted**
- There are technology challenges
- Need to balance capabilities against cost drivers
- Market research will help structure program requirements
- Industry inputs through one-on-ones and ongoing dialogue necessary/desired



We are Open To All Workable Solutions